Space Weather Technical Forecast

Issued on Sunday, 03 March 2024 at 01:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Risk of M or X-Class flares from ex-AR3590 just beyond northwest limb declining slowly. Low risk of Active intervals possible from any CME arrivals early on 03 March.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Activity has been Low through the last 24 hours with a peak C6.6 flare from AR3595 in the northwest quadrant. This is a large and developing region, but is still only producing limited activity. AR3598 in the southwest is also developing and is becoming increasingly magnetically complex, with a possible delta spot emerging in the centre of the region. Ex-AR3590 has now rotated across the northwest limb, but magnetic looping is still visible above the solar limb. The remaining regions are stable or weak, but two regions towards the southeast limb will be monitored as they rotate further onto the visible disc. No Earth directed CMEs were identified in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds observed at L1 by ACE have been representative of a background solar wind environment, with winds below 300km/s. Density has also been below average. Total magnetic field strength, IMF, has been weak, below 5nT and the north-south component, Bz has been mainly negative but has varied between -4nT and +1nT. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity was Quiet throughout.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels with the associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 03/0000UTC was 3.5e6 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Low activity is expected with a decreasing likelihood of M-class and X-class flaring from ex-AR3590, with a current slight chance of an increasing risk from AR3595 and AR3598 in the western hemisphere.

Solar Wind / Geomagnetic Activity: Three CMEs may glance the Earth early on 03 March with a low likelihood. Otherwise the Earth is expected to remain in a benign solar wind environment, with no coronal hole high speed streams expected. Geomagnetic activity is forecast to be mainly Quiet with some Unsettled periods. There is a low risk of Active or G1/Minor Storm intervals from any CME arrivals.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is likely to stay at background levels, but with a slight chance of rising above S1 levels in response to any notable flares mainly from ex-AR3590 as this region rotates further beyond the northwestern limb. GOES16 high energy electron flux is expected to remain at background levels with the associated 24hr fluence remaining well below the Active threshold throughout.

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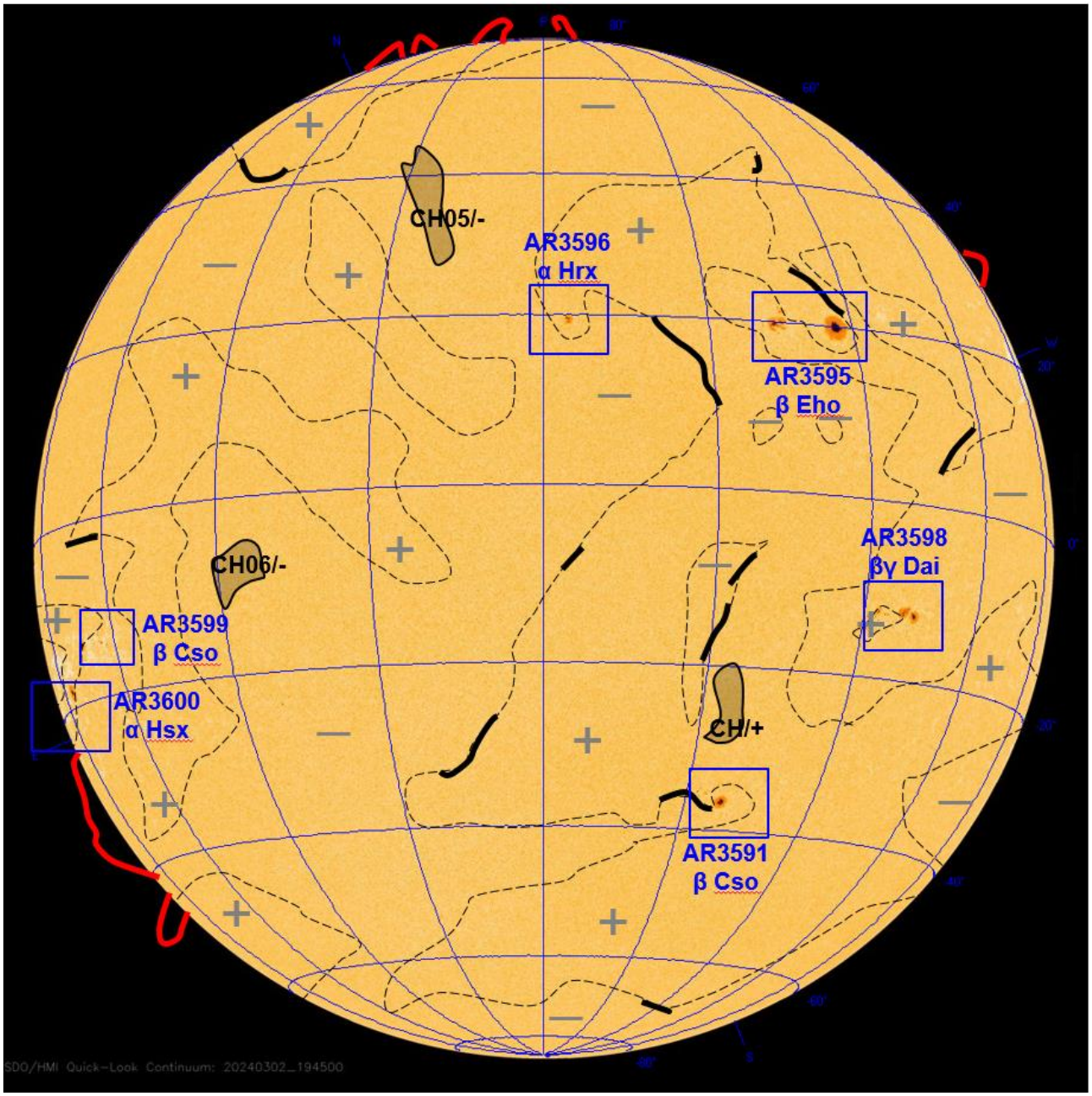
Figure 1. Solar Analysis Valid 02/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Three CMEs are forecast to potentially glance the Earth early on 03 March. One of these left the Sun late on 27 February, with two from 28 February, although there is uncertainty in the modelling of all three due to lack of sufficient satellite imagery.

In the absence of any CME enhancements, solar winds are expected to remain at background levels in a benign solar wind environment. A weak coronal hole, just to the west of south centre disc is not likely to produce significant effects.

Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals. Active intervals are possible early on 03 March, with a decreasing risk and a very slight chance of G1/Minor Storm intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/1856	Partial	Filament	South-centre	450 km/s	03/0000 UTC	Glance possible
28/1335	Partial	Filament	Southeast	750 km/s	02/1800 UTC	Glance possible
28/1743	Partial	Uncertain	Northeast	460 km/s	02/2100 UTC	Glance possible

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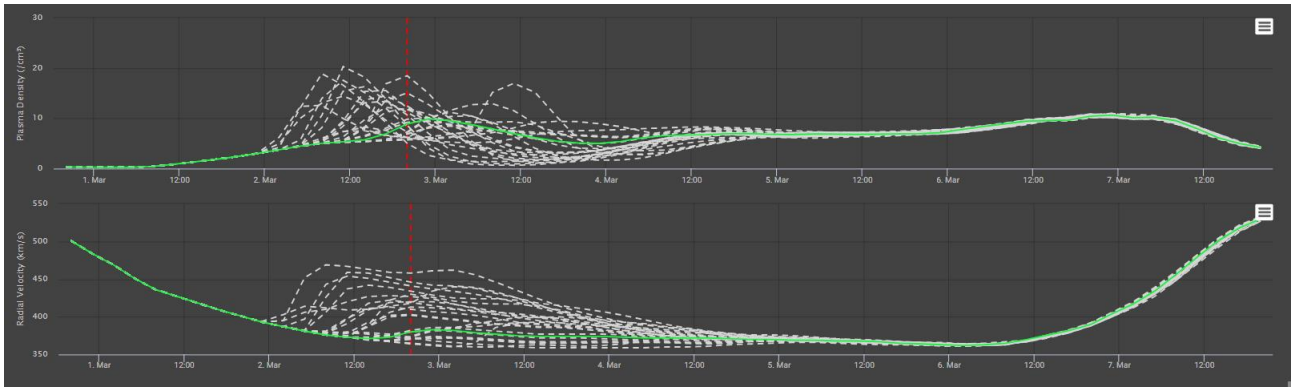
Figure 2: MOSWOC Enlil ensemble, showing the spread of potential CME arrivals, demonstrated by the range of different solutions within the ensemble model.



Radio Blackouts - X-Ray Flares:

Solar activity has been Low with a peak C6.6 flare from AR3595 which is a large and complex region in the northwest quadrant. AR3598 in the southwest quadrant is also large and complex, and although activity has been relatively muted, the region is becoming increasingly complex and is potentially developing a delta spot in the central portion. Ex-AR3590 rotated off the northwest limb during the last 24 hours, but could potentially produce flares which could be visible at Earth from beyond the limb through the next 24-36 hours.

The remaining regions are small or weakening, although the two regions close to the southeast limb will be monitored as they continue to rotate onto the visible disc.

Low activity is expected, with a decreasing likelihood of M-class flaring through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	40	20	20
Very Active	R3 to R5 X Class	No	10	5	1	1

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Figure 3: GOES-16 X-ray flux

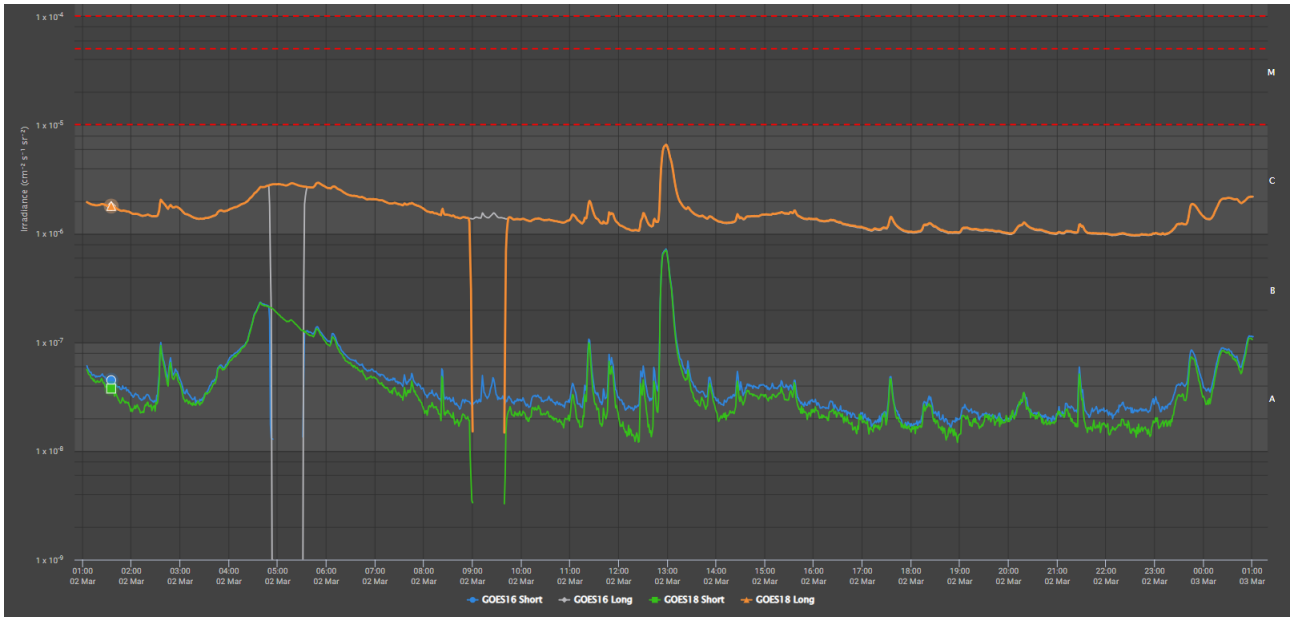
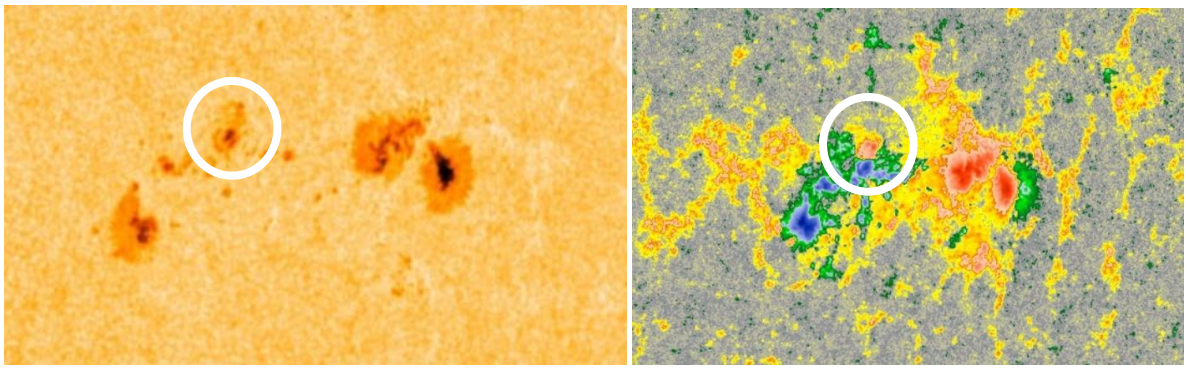


Figure 4: AR3598 in the southeast quadrant, shown at on both SDO intensitygram and magnetogram imagery. The potential delta spot is circled in the centre of the group.



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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels, and is likely to remain so through this period. There is a slight chance of enhancement from any major flare associated with ex-AR3590 from the far side of the northwest limb, with this risk decreasing through the next 24-36 hours. A further risk may evolve from AR3598 which appears to be developing a central delta spot and will continue to be on the visible disc throughout the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	15	15	5	5
Very Active	≥ S3 *	No	5	5	5	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than "MeV) is expected to remain at background levels in the absence of any significant solar wind inputs.

Corresponding high energy electron fluence is expected to remain well below the Active threshold (1e8 integrated pfu).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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